



## ***Document Purpose***

*This document is an addendum to the overarching Okeanos Explorer FY12 Data Management Plan (EX\_FY12\_DMP.pdf) and is specific to the EX-12-05 Leg 1 mission entitled “Exploration, Blake Plateau” For more detailed information on the data management effort for the Okeanos Explorer in FY12, please refer to that document.*

## **General Description of the Data to be Managed**

During the *Okeanos Explorer* (EX) mission EX1205L1, the vessel will sail from Davisville, RI to the Hatteras Transverse Canyon in the Western Atlantic for deepwater testing of the Sentry AUV. The vessel will then sail to the Blake Ridge off of the Carolina Coast and explore the Blake Ridge Diapir and Cape Fear Diapir Complexes before docking in Morehead City, NC. Data to be managed includes ship and AUV multibeam survey data including water column and bottom backscatter, XBT firings for survey system calibration, CTD casts, sub-bottom profiles, side scan sonar data, single beam sonar data, meteorology, navigation and oceanographic sensor data, and high resolution benthic digital photos. Data management procedures are fully documented in the data management plan for the Okeanos Explorer for the FY12 field season (EX\_FY12\_DMP.pdf)

- Name of Dataset
  - : “EX1205L1: Exploration, Blake Plateau”
- Mission Specific Keywords:
  - Place Specific:
    - Davisville
    - Rhode Island
    - South Carolina Coast
    - Blake Plateau
    - Blake Ridge
    - Hatteras Transverse Canyon
    - Morehead City
    - Atlantic Continental Shelf Break
  - Theme Specific:
    - Multibeam
    - Multibeam sonar
    - Sub-bottom profile
    - Mapping survey
    - Photosurvey
    - Multibeam backscatter
    - Water column backscatter
    - CTD
    - Duke University

Marine Laboratory

- Nicholas School of the Environment
- Duke University
- Woods Hole Oceanographic Institute
- WHOI
- Sentry AUV
- Sentry
- Autonomous underwater vehicle
- National Marine Sanctuaries
- Blake Ridge Diapir
- Cape Fear Diapir
- Diapir Complex
- Canyons Transit Line
- Benthic habitats
- Seep communities
- Clam beds
- Mussel beds
- Unbreached diapirs
- Methane hydrates
- R/V Endeavor
- National Science Foundation
- U.S. Geological Survey

- Summary description:

The EX-12-05 Leg 1 cruise represents a partnership between NOAA Okeanos Explorer Program, National Science Foundation (NSF) and Woods Hole Oceanographic Institution (WHOI) - with each partner bringing different but complementary objectives to the table. The primary focus for the Office of Ocean Exploration and Research (OER) during EX-12-05 Leg 1 is to test the use of an AUV operated from the Okeanos Explorer while the ship is outfitted for "full" exploration mode and to explore what it will take to integrate an AUV into telepresence-enabled exploration. NSF and WHOI objectives for this cruise include a series of engineering trials and experiments of the Sentry AUV capabilities. NSF objectives for this cruise also include survey data collection using the Sentry AUV and Okeanos Explorer systems that will support a follow-on NSF-funded project at Blake Ridge in 2013 with Principal Investigator, Cindy Van Dover.

- Temporal Bounds:

- July 5 – July 24, 2012

- Spatial Bounds:

- Northern: 41.7
  - Southern: 31.6
  - Western: -76.7
  - Eastern: -72.4

- Data Type Collections for Preservation/Stewardship:

- Ship

- Multibeam Bathymetry – non-continuous collection during the duration of the expedition. Multibeam bathymetry will be collected by the ship while the AUV is on deck. While deployed only the Sentry AUV will be used to collect bathymetry.
    - Bottom Backscatter – non-continuous collection during the entire duration of the expedition

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- Water Column Backscatter – non-continuous collection during the entire duration of the expedition
- Scientific Computing System (SCS) output – continuous collection of navigational, meteorological, integrated oceanographic sensor data
- XBT – continuous casts every 2-4 hours collecting water temperature at depth for sound velocity calculations to maintain multibeam data quality
- CTD –casts with Rosette firings collecting conductivity, temperature, depth and water samples at targeted depths
- Knudsen CHIRP 3260 –sub-bottom profiler data as deemed appropriate by the ship
- EK60 – single beam sonar for water column features during the entire duration of the expedition
- Sentry AUV (details still TBD)
  - Edgetech CHIRP 2-24kHz sub-bottom profiler data while Sentry AUV is in operation
  - Side Scan Sonar – continuous side scan sonar data will be collected while Sentry AUV is in operation
  - Seafloor photography – continuous high definition images will be collected by Sentry AUV while in operation
- Data Product/Product Collections for Preservation/Stewardship:
  - Ship
    - Gridded bathymetry (.txt)
    - Gridded bathymetric image (.tif)
    - Fledermaus gridded bathymetry imagery (.sd)
    - Fledermaus gridded backscatter imagery (.sd)
    - Google Earth gridded bathymetry (.kml)
    - ArcView gridded bathymetry (.asc)
    - SCS data output in NetCDF
    - CTD data output in NetCDF
    - Final Mapping Summary document
    - Final Cruise Summary document
  - Sentry AUV (formats still TBD)
    - High Resolution Bathymetric Photographs
    - Sentry sensor and navigation data
    - Strip plots in a GeoTIF format
- Volume of Data Expected
  - The volume of data expected from this cruise is still TBD. The data management plan will be updated with this information as soon as it is available.
- Personally Identifiable Information (PII) concerns
  - No PII will be included in these data.

### Points of Contact

- Overall Point of Contact (POC) for the data:
  - Data Acquisition: Elizabeth (Meme) Lobecker ([Elizabeth.Lobecker@noaa.gov](mailto:Elizabeth.Lobecker@noaa.gov)) and Adam Skarke ([Adam.Skarke@noaa.gov](mailto:Adam.Skarke@noaa.gov))
  - Data Management: Susan Gottfried ([Susan.Gottfried@noaa.gov](mailto:Susan.Gottfried@noaa.gov))
- Responsible for Data Quality:
  - Seafloor mapping and water column data: (Meme) Lobecker and Adam Skarke

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- SCS data: Office of Marine and Aviation Operations (OMAO): Lt. Laura Gallant, Okeanos Explorer Operations Officer ([Ops.Explorer@noaa.gov](mailto:Ops.Explorer@noaa.gov))
- Responsible for data documentation and metadata activities:
  - National Coastal Data Development Center (NCDDC); Susan Gottfried, OER Data Management Coordinator
- Responsible for the data storage and data disaster recovery activities:
  - NOAA National Data Centers; National Oceanographic Data Center (NODC), National Geophysical Data Center (NGDC), NOAA Central Library (NCL)
- Responsible for ensuring adherence to this data management plan, including resources are made available to implement the DMP:
  - Data Acquisition: Kelley Elliott, Expedition Coordinator
  - Data Acquisition: Meme Lobecker, Mapping CO-Mapping Lead
  - Data Acquisition: Adam Starke, Mapping CO-Mapping Lead
  - Data Acquisition: Lt. Laura Gallant, OMAO, Okeanos Explorer Operations Officer
  - Data Management: Susan Gottfried, OER Data Management Coordinator

### Data Stewardship

- What quality control procedures will be employed?
  - Quality control procedures for the data from the Kongsberg EM302 is handled at UNH CCOM/JHC. Raw (level-0) bathymetry files are cleaned/edited and converted to a variety of products.
  - Data from sensors monitored through the SCS are archived in their native format and are not quality controlled.
  - Quality control procedures for the data from the Sentry AUV is handled by WHOI AUV team. Raw (level-0) bathymetry files are cleaned/edited and converted to a variety of products using same procedures as EM302.
- What is the overall lifecycle of the data from collection or acquisition to making it available to customer?
  - All ship data from this mission is expected to be archived and accessible within 60-90 days post-mission.
  - METOC data from the SCS are converted in a post-mission model into archive-ready compressed NetCDF3 format and stored within the NODC THREDDS open-access server.
  - CTD data from casts are processed in a post-mission model and converted into archive-ready compressed NetCDF3 format and stored within the NODC THREDDS open-access server.
  - Sentry AUV data is expected to be captured and processed on a daily basis. Archival of AUV data is TBD

### Data Documentation

- An ISO format metadata record to document the mission will be generated during pre-cruise planning and published in an OER catalog for public discovery and access. Documentation templates will be provided for post-mission products with references back to the overall mission metadata documents. Data collections and products will be documented with ISO or FGDC CSDGM metadata and published at the appropriate NOAA Data Center.
- ISO 19115-2 Geographic Information with Extensions for Imagery and Gridded Data will be the metadata standard employed.

## Data Sharing

- All data recorded, observed, generated or otherwise produced on the Okeanos Explorer are considered non-proprietary and will be made available to the public as soon as possible after a period of due diligence in performing quality assurance and data documentation procedures.
- Data from the Sentry AUV will be shared for inclusion in the near real-time Okeanos Atlas and for archival procedures.

## Initial Data Storage and Protection

- Data are recorded and stored on NOAA shipboard systems compliant with NOAA IT procedures. Data are moved from ship to shore using a variety of standard, documented data custody transfer procedures. Data are transferred to NOAA data centers using digital and physical data transfer models depending upon data volume.

## Long-Term Archiving and Preservation

- Data from this mission will be preserved and stewarded through the NOAA National Data Centers. Refer to the Okeanos Explorer FY12 Data Management Plan (EX\_FY12\_DMP.pdf) for detailed descriptions of the processes, procedures, and partners involved in this collaborative process. Appendix A has an excerpt from EX\_FY12\_DMP.pdf that illustrates the data and product pipelines that will be employed for this mission.

## Data Management Objectives

The DMT's objectives for this mission are:

- At-Sea Objectives
  - Facilitate standard file structure and naming conventions
  - Facilitate AUV products through rsync procedure to shore side repository server
  - Optimize ship-to-shore data throughput for shore side AUV team
  - General Q&A data management
- Real-Time Objectives
  - AUV Track (kml)
  - AUV Bathymetry geotiff
  - Ensure the near real-time update of the *Okeanos Atlas* with
    - Ship track and hourly observations received via email.
    - Daily logs pulled from URI through RSS feeds and links to related images on [oceanexplorer.noaa.gov](http://oceanexplorer.noaa.gov) website.
    - CTD cast locations with thinned profiles to be compared to the World Ocean Atlas historical profiles for the general location and month.
    - Daily cumulative bathymetric image overlays received via URI SRS.
    - Execute multibeam and oceanographic data pipelines according to the FY12 DMP (EX\_FY12\_DMP.pdf).
- Develop ISO metadata for collection-level and dataset-level records collected from the ship and the Sentry AUV (multibeam, singlebeam sonar, sub-bottom profiler, XBT, CTD, EX METOC,)
- Ensure compliance with EX12 Data Pipelines

## Expedition Principals for Data Management

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Susan Gottfried, NCDDC, OER Data Management Coordinator, [Susan.Gottfried@noaa.gov](mailto:Susan.Gottfried@noaa.gov)

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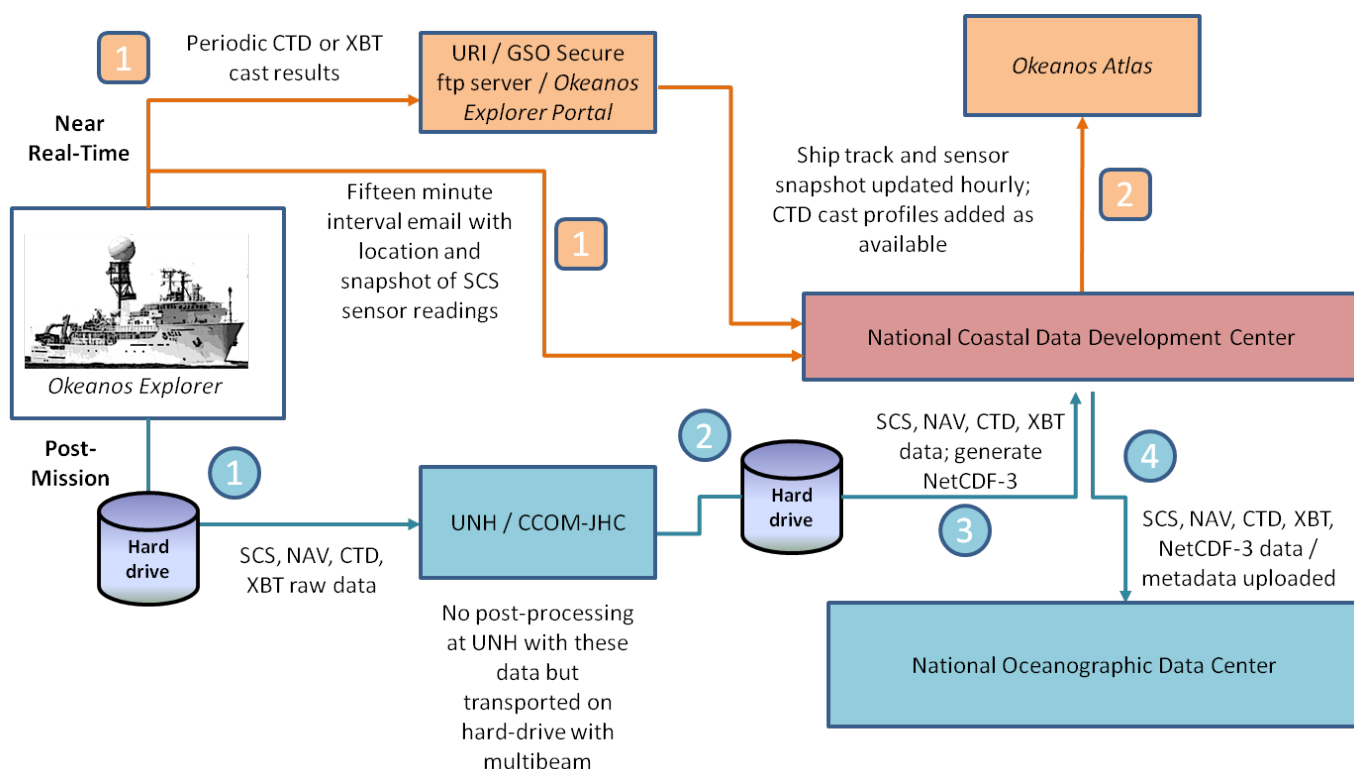
Tom Ryan, NODC, Oceanographic Data Officer, [Thomas.Ryan@noaa.gov](mailto:Thomas.Ryan@noaa.gov)

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**Appendix A: Data and Product Pipelines (excerpt from EX\_FY12\_DMP.pdf)*****Oceanographic/Meteorological/Navigational Data Archive Pipeline***

Data from hull-mounted and off-board oceanographic and meteorological (METOC) sensors; integrated oceanographic sensors from the submersibles; and navigational instrumentation on both the vessel and its submersibles are monitored through the ship's Scientific Computer System (SCS). Some of these data will be used in a near real-time mode to update the *Okeanos Atlas*. All of these data will be archived at the National Oceanographic Data Center (NODC) Marine Data Stewardship Division (MDSD) in Silver Spring, MD. A collection level metadata record describing the data inventory to be archived at the NODC/MDSD will be included with the data submission.

### Oceanographic/Meteorological/Navigational Data/Products Pipeline



**Fig 1: Oceanographic/Meteorological/Navigational Data Archive Pipeline**



1

At periodic (currently twenty minutes) intervals, an email from the ship to NCDDC is delivered with the ship's position and a snapshot of the SCS sensor suite.

As CTD or XBT casts are deployed, the results of the cast are included in the hourly synchronizations to the SRS.

2

The GIS team at NCDDC processes CTD cast data into thinned profiles for comparison to World Ocean Atlas historical profiles in the same region and month. The thinned profiles are geo-located on the Okeanos Atlas. Ship track and sensor snapshot readings are geo-located on the Okeanos Atlas.

1

All SCS data, including navigation and CTD/XBT cast data are saved to a hard-drive. This hard-drive is the same that will hold the multibeam survey raw data and products generated on-board. This hard-drive will be either brought back or shipped to the University of New Hampshire Center for Coastal and Ocean Mapping (UNH CCOM) for post-processing, after which it will be shipped to NCDDC.

2

The Data Management team will post-process the SCS, NAV, CTD, and XBT raw data files, adding ASCII headers to each file and generating NetCDF-3 formatted files for the entire cruise for both SCS/NAV data and CTD/XBT data. FGDC CSDGM metadata will be generated for the navigational data and for the METOC sensor data.

3

The ASCII files, and the metadata will be uploaded to the National Oceanographic Data Center (NODC), where they will be accessioned and archived.

4

The NetCDF3 files will be stored within an NCDDC hosted Thematic Real-time Environmental Distributed Data Services (THREDDS) server for user discoverability and access.

Data Class	Instrument	Data Type	Format	Metadata Granularity	Archive Center
<b>OCN/MET</b>	All SCS monitored sensors	Meteorological and Oceanographic data sensors	ASCII	1 meta rec	NODC/MDSD
<b>NAV</b>	DGPS, CNAV	EX, ROV, and sled navigation	ASCII	1 meta rec	NODC/MDSD
<b>ALL</b>	All	Archive Ready	NetCDF-3	1 meta rec	NODC/MDSD

*Table 4: Oceanographic/Meteorological/Navigational Metadata Granularity and Target Archive*



## Multibeam Survey Data Archive Pipeline

The multibeam survey data collected by bottom-looking and complementary sensors, data from the calibration instruments, and the products generated after the data is returned to and post-processed at UNH will be archived at the NGDC. These data will be accompanied with a collection level metadata record for the NGDC as well as individual metadata records for each raw (level-0) file, each edited (level-1) file and each data product (level-2) and report (level-3) generated as a result. In addition, the submission to NGDC will include the following:

- raw (level-0) mapping survey and water column data files,
- CTD and/or XBT profile data used for calibration in multibeam survey,
- post-processed, quality assured, and edited (level-1) data files,
- specific data products (level-2) including cumulative GeoTIF images, gridded bathymetric files, KML files, Fledermaus output files, and an ArcGrid format, and
- comprehensive mapping survey data summary (level-3) report.

### Multibeam Data/Products Pipeline

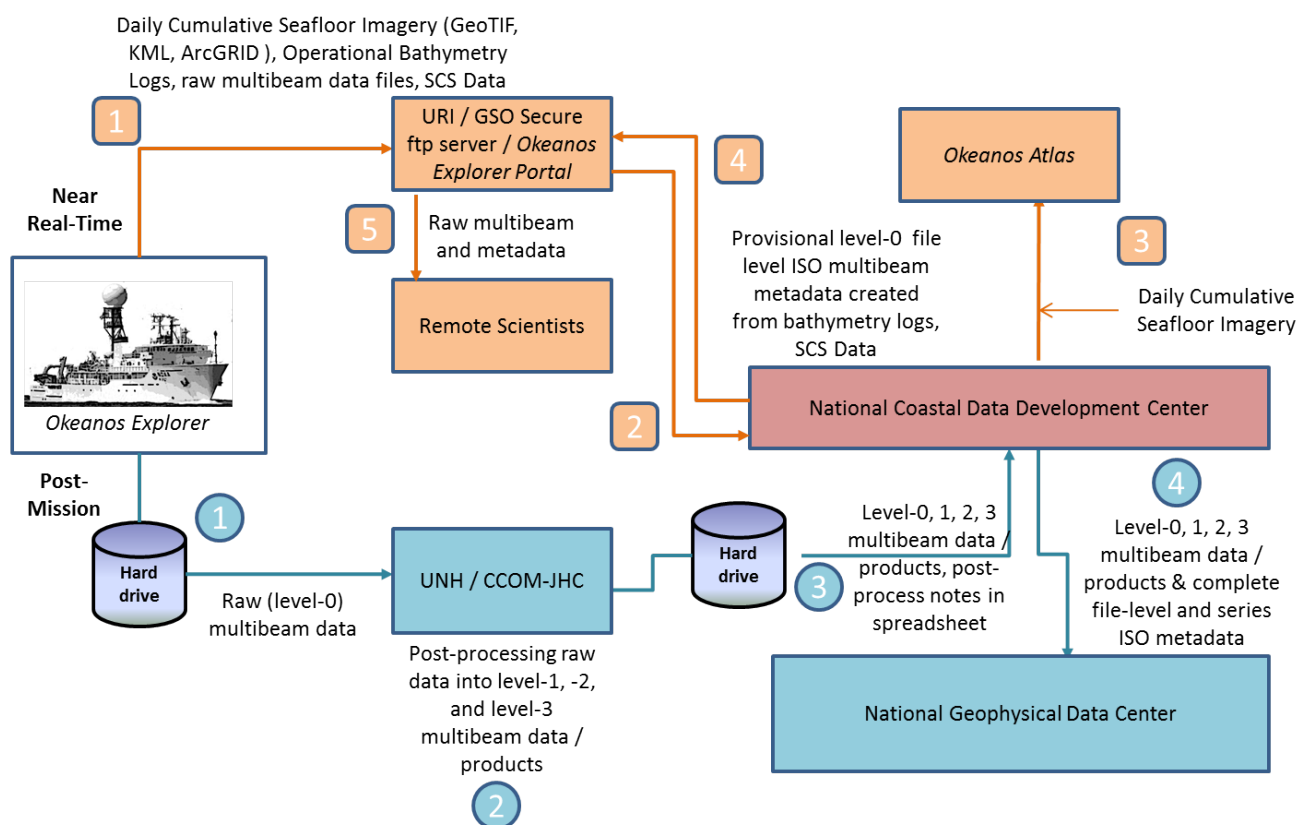


Figure 2: Multibeam Survey Data Archive Pipeline

## Near Real-Time

1

The mapping survey team on the EX will include their operational processing spreadsheet in the folder that is targeted for synchronization to the SRS periodically throughout the day. As operational GeoTIFF images are created, these will also be saved to this folder.

2

The data management team at NCDDC pulls the GeoTIFF images, operational bathymetry processing spreadsheet and the SCS data streams for near real-time metadata generation and Okeanos Atlas update procedures.

3

Daily cumulative GeoTIFF images of the seafloor imagery are geo-located on the Okeanos Atlas by the GIS team at NCDDC.

4

Provisional metadata in an ISO format is generated for each raw (level-0) multibeam raw files using the SCS exported data, the operational processing spreadsheet and saved to the SRS.

5

Participating scientists wanting access to the raw multibeam in near real-time can pull the individual files with the metadata that provides operational and provisional processing steps and a disclaimer for non-QC status of the data.

## Post-Mission

1

All bottom-looking sensor data and complementary data (water column and sound velocity) are saved to a hard-drive. This hard-drive will be either brought back or shipped to the University of New Hampshire Center for Coastal and Ocean Mapping (UNH CCOM) for post-processing.

2

A full complement of multibeam data from a 30-day EX cruise on which the Kongsberg EM302 multibeam system runs continuously will produce 200-300 Gigabytes of raw multibeam (37.5% of total volume) and water column data (62.5% of total volume). At UNH, the mapping team will post-process the multibeam data through the following steps:

- The raw (level-0) data will be saved to the CCOM file servers, where they will be quality checked and post-processed.
- The edited level-0 data is saved as level-1 data files in a non-proprietary format – ASCII xyz files (cleaned not gridded).

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- The post-processing steps used to produce the level-1 data will be documented.
- Level-2 products will be generated from the level-1 data files.
- The post-processing steps used to produce the level-2 data products will be documented.
- The level-1 data, level-2 products, post-processing steps, and working data processing spreadsheets will be copied to the hard drive in a new folder. A processing spreadsheet for FY12 will contain the temporal and spatial limits of each file and any supplemental information documenting problems or issues that affected the quality of the data in that file.

3 The hard-drive will be shipped to the NCDDC within approximately 3 weeks from cruise end date.

4 At NCDDC, all multibeam related files will be post-processed through metadata generation procedures. Metadata will be generated for each individual survey track file (level-0 and -1), for accompanying CTD/XBT profile data sets, for composite xyz files, KMLs, GeoTIFs, png images, and Fledermaus output (level-2), and a set of data products and reports (level-3). The metadata will be added to the hard-drive and the hard-drive will be shipped to NGDC.

NOAA Ship Okeanos Explorer					
Data Class	Instrument	Data Type	Format	Metadata Granularity	Archive Center
<b>GEO</b>	Kongsberg EM302 (30 kHz)	Multibeam Bathymetry, Bottom Backscatter, Water Column Backscatter (proprietary format read into MBSsystem)	.all, .wcd (proprietary)	1 meta rec per .all file in Multibeam Data folder and subfolders	NGDC
<b>GEO</b>	Simrad EK60	Singlebeam (time,depth)	.txt, (ASCII), .raw (proprietary)	Included in the SCS feed	TBD
<b>GEO</b>	Knudsen CHIRP 3260 (3.5 kHz)	Sub-bottom profile	.sgy, .kea, .keb (proprietary)	1 meta rec = Subbottom Profile Data folder	NGDC
<b>OCN</b>	SeaBird SBE-911plus	CTD Cast	.hex, .con (Proprietary); .cnv, .hdr, .bl, .jpg (processed)	1 meta rec = CTD folder	NGDC
<b>OCN</b>	Sippican MK-21 eXpendable BathyThermograph (XBT)	XBT	.edf (ASCII), .rdf (proprietary)	1 meta rec = XBT folder	NGDC
<b>OCN</b>	RESON	Sound Velocity (m/s)	TBD	1 meta rec = RESON folder	NGDC
<b>OCN</b>	Calculated	Sound Velocity (m/s)	.asvp (ASCII)	1 meta rec = Profile_Data/SVP or Profile_Data/ASVP	NGDC
Sentry AUV					
Data Class	Instrument	Data Type	Format	Metadata Granularity	Archive Center
<b>GEO</b>	Reson 7125	Multibeam Bathymetry	.mb88, .s7k		NGDC
<b>OCN</b>	Edgetech CHIRP (4kHz to 20kHz)	Sub-bottom profile			NGDC
<b>OCN</b>	Fluxgate magnetometer				NGDC
<b>OCN</b>	1Kx1K 12 bit color still camera		.tif, .kmz, .jpg		NGDC

Table 5: Multibeam Survey Metadata Granularity and Target Archive